Bonding properties and performance of multi-layered kenaf board

ABSTRACT

Kenaf (Hibiscus cannabinus) has recently been introduced to the Malaysian bio-composite industry. Based on their basic properties, both the bast fibres and core material of kenaf are distinctly different. While bast fibres are stiffer and low in wettability, the core material of kenaf is weaker and has excellent absorbing properties. This study evaluated the properties of kenaf board made from a combination of bast fibres and core material. The bast fibres were separated first from the core, followed by pre-treatment with NaOH, then combing until the fibres became loose. The properties of kenaf board were tested using MS standards 1787: 2005. An analysis of variance was carried out to study the effects of resin types and bast to core proportion on the boards. The buffering capacity study revealed that kenaf bast, kenaf core and rubberwood behaved similarly in alkali but differently in an acidic condition. Both the kenaf bast and core were relatively less stable in acid compared with rubberwood. Due to its morphological characteristics, the kenaf core inner surface exhibited higher wettability than the outer surface. There was significant interaction between resin type and the proportion of bast:core at $p < 0.01$. Generally, boards made from 100% kenaf core and bonded with urea formaldehyde (UF) resin had superior performance. The mechanical properties [modulus of elasticity (MOE), modulus of rupture (MOR), internal bond (IB)] of the boards were significantly influenced by the amount of bast fibre in the boardï ï the higher the amount, the poorer the strengths. This effect, however, was reversed for thickness swelling (TS). Only UF-bonded kenaf-based boards had comparable water absorption (WA) property to that of the control (100% rubberwood). The incorporation of low molecular weight phenol formaldehyde (LPF) resin in the fibres had mixed effects on board properties. The effects varied based on the resin used; it improved the MOE and MOR of the board but not the IB, TS and WA when used with UF resin. It improved the IB only when used with melamine urea formaldehyde (MUF) resin. The best performance was given by boards made from 100% kenaf core irrespective of the type of resin used. All kenaf boards in this study had higher MOR than that of 100% rubberwood. Insufficient curing of LPF resin was identified as the main factor for the poor performance of LPF-bonded boards.

Keyword: Wettability; Buffering capacity; Bast fibre; Core material